

**Plains Midstream Canada ULC
NPS 12 Rangeland South**

**Pipeline Failure and Release
into the Red Deer River**

**Licence No. 5844, Line 1
June 7, 2012**

AER Investigation Report

March 4, 2014

Alberta Energy Regulator

AER Investigation Report: Plains Midstream Canada ULC, NPS 12 Rangeland South, Pipeline
Failure and Release into the Red River, June 7, 2012

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Abbreviations

Acuren	Acuren Group Inc.
AEMA	Alberta Emergency Management Agency
ESRD	Alberta Environment and Sustainable Resource Development
AHS	Alberta Health Services
AMU	air monitoring unit
API	American Petroleum Institute
BV	block valve
CSA Z662	Canadian Standards Association Z662: Oil and Gas Pipeline Systems
DNV	Det Norske Veritas Canada
AER	Alberta Energy Regulator
ERP	emergency response plan
HSE	HSE Integrated Ltd.
km	kilometre
kPa	kilopascal
LSD	Legal Subdivision
masl	metres above sea level
Matrix	Matrix Solutions Inc.
m ³ /s	cubic metres per second
MDT	Mountain Daylight Time
mm	millimetre
MP	mile post
NHC	Northwest Hydraulic Consultants
NOTAM	Notice to Airmen
NPS	nominal pipe size
PIISP	Petroleum Industry Incident Support Plan
PINS	Pipeline Incident Notification System

Plains	Plains Midstream Canada ULC
ULC	Unlimited Liability Corporation
RCMP	Royal Canadian Mounted Police
RPC	Rangeland Pipeline Company
RDFC	Red Deer Field Centre
SCADA	supervisory control and data acquisition
SIR	Supplemental Information Request
SPOG	Sundre Petroleum Operators Group
SWAT	SWAT Consulting Inc.
Rangeland pipeline	NPS 12 Rangeland south pipeline
USAS	United States American Standards Institute
WCSS	Western Canadian Spill Services

Executive Summary

On June 7, 2012, at 17:41 Mountain Daylight Time (MDT),¹ Plains Midstream Canada ULC's (Plains's) automated pipeline monitoring system detected abnormal operating conditions on a pipeline licensed to and operated by Plains. Flow in the pipeline, known as the nominal pipe size NPS 12 Rangeland south pipeline (Rangeland pipeline), triggered an "alarm." The alarm was the first observed indication of what was later identified as a release of a reported 462.75 cubic metres (m³) of crude oil into the Red Deer River. At 18:50, a landowner reported indications of the release about 5 kilometres (km) downstream of the release point to a representative of the Sundre Petroleum Operators Group (SPOG). The actual release point was later discovered by a helicopter contracted by a SPOG member company at 21:57 at the Rangeland pipeline water crossing near the west bank of the Red Deer River about 3 km north of Sundre, Alberta.

The crude oil release affected landowners and businesses downstream for about 40 km from the release point to the Dickson Dam reservoir. The release also had a negative economic impact on a number of businesses operating upstream of the release site.

At the time of the release, the river flow was about ten times the seasonal flow. It was determined that the pipeline failed at a circumferential (girth) weld located along the west bank of the Red Deer River. The Plains third party investigation indicated that the pipeline failed due to high-cycle fatigue, likely caused by vibrations induced by river flow. The investigation also indicated that the failed portion of the pipeline must have been exposed during the failure and was likely uncovered by scour. Furthermore, the failed section met all applicable manufacturing requirements at the time of installation. Corrosion, a deficient weld, or other material property failures of the section of pipeline are not considered to have contributed to the break.

The release was reported by SPOG and Plains, respectively, on June 7, 2012, to multiple agencies, including the Alberta Energy Regulator (AER)² and Alberta Environment and Sustainable Resource Development (ESRD). Remediation efforts started soon after the incident and were approved and supervised by ESRD.

The AER's audit of Plains's emergency response plan determined that Plains did not meet the requirements of *Directive 071: Emergency Preparedness and Response Requirements for the*

¹ All times in this report are in MDT.

² On June 17, 2013, the *Responsible Energy Development Act* was proclaimed, and the AER was created. Although events may have taken place under its predecessor, the Energy Resources Conservation Board, for simplicity, "the AER" will be used throughout.

Petroleum Industry. Due to the volume of crude oil released as a result of the incident and the fact that it occurred in a highly populated rural area, communicating with and engaging residents was difficult, especially in the early stages of the incident. Due to concerns regarding deficiencies in Plains's communications with stakeholders about the incident, AER communications staff had to direct Plains's communications throughout the incident.

The AER investigated Plains's pipeline integrity management plan and actions prior to the release and determined that the pipeline failure was caused by a combination of high river flow and deficiencies in Plains's pre-incident administration and management of the pipeline. The AER concludes that

- Plains failed to inspect the Rangeland pipeline annually as required by the *Pipeline Rules*, part 4, section 43(1),
- Plains failed to complete inspections of the pipeline at the required frequency according to its own pipeline integrity management program,
- Plains failed to apply appropriate mitigation measures according to its own hazard assessment (which included scour [erosion of river bed under pipe]),
- had Plains responded to the Government of Alberta's High Streamflow Advisory issued prior to the incident, it could have isolated, cleaned, and purged the pipeline section, leaving the pipeline in a safe condition. Had Plains performed these measures, the release may have been prevented or, if not prevented, significantly lower volumes of fluid would have been released.

By letter dated July 4, 2013, the AER issued four High Risk Enforcement Actions against Plains in connection with the incident. Plains has appealed three of those enforcement actions. The AER is currently processing the appeals in accordance with *Directive 019: Compliance Assurance*. Decisions will not be made until the investigation report is released.

As a result of the findings in this report and the AER enforcement actions against Plains in connection with the incident, the AER reminds licensees of the following requirements under Canadian Standards Association *CSA Z662: Oil and Gas Pipeline Systems* adopted by the AER:

- Pipeline licensees and operators who identify pipeline risks that can lead to failure must reduce or eliminate the risk through an engineering assessment (clause 10.3 in *CSA Z662*).
- If a pipeline licensee or operator identifies a potentially significant risk to the public, environment, or property (in this case flowing water), all attempts to reduce or eliminate a failure must be considered (clause 3.1 and annex N in *CSA Z662*).

- Where relevant information is not available, operators must conduct inspections or testing, or make conservative assumptions that can be supported by rational analysis and valid system experience, to enable an engineering assessment to be carried out and risks and environmental impacts to be minimized (clauses 3.3.3.2 and 3.3.3.3 of CSA Z662).

In addition, the AER recommends (indicated by “should”) and requires (indicated by “must”) the following:

For Plains

- At the time of the incident, the risks of a washout and “bed scour for a 55 m length of pipeline in the primary channel” at the subject river crossing were high. Consequently, Plains should develop, implement, and communicate procedures to shut in, isolate, clean, and purge its pipeline during high seasonal flow. Plains should also address the long-term integrity of the pipeline crossing by replacing the river crossing pipeline sections with a directionally drilled crossing or by further protecting the remaining crossing outside of the current groynes using similar methods. In doing so, Plains must also ensure that it complies with applicable provisions of the *Water Act* (*Water Ministerial Regulation* and the *Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body*).
- As per CSA Z662, in situations where exact depth of cover information is not available, Plains is required to develop, implement, and communicate procedures that assume the worst case scenario (exposure of pipeline) until clear and verifiable information on depth of cover can be obtained. Plains must take all steps necessary to ensure compliance with this requirement.
- A block valve existed a few hundred metres to the south and east of the river, but the next block valve upstream was at the pump station about 14 km away. A Stopple was required to limit gravity drainage towards the river and to control and contain the release. The location of the block valves at this crossing location was clearly not sufficient to mitigate the risk and minimize the impact of the incident. CSA Z662, clause 4.4.8, requires licensees to install valves on both sides of major water crossings in order to limit damage from accidental discharge. Plains must reassess all of its pipeline water crossings to ensure that all isolation valves are appropriately located and operated in a manner that complies with this requirement.

In addition, Plains must implement, maintain, and communicate documented policies and procedures outlining when and in what circumstances isolation valves must be activated (e.g., immediately following warnings of increased streamflow).

- Plains should become more actively involved in local synergy groups and mutual aid organizations in all areas where it operates, as the actions (or inactions) of one member company (in this case Plains) can significantly impede the effectiveness of incident response.

For the AER

- The AER should consider its role in engagement and communication activities with licensees to ensure that information is disseminated as efficiently as possible.
- The AER should audit Plains's emergency response and integrity management plans. In its order dated July 4, 2013, issued under section 22 of the *Oil and Gas Conservation Act*, the AER stated that it will perform a full audit of Plains's operations regarding emergency planning and response, safety and loss management systems, risk assessment and mitigation, communications and stakeholder relations, regulatory reporting, and progress in connection with action plans required in response to enforcement.

1 Incident Description

On June 7, 2012, at 17:41 Mountain Daylight Time (MDT),¹ Plains Midstream Canada ULC's (Plains's) supervisory control and data acquisition (SCADA) system detected abnormal operating conditions (low pressure and abnormal flow) on a pipeline licensed to and operated by Plains known as the nominal pipe size (NPS) 12 Rangeland south pipeline (Rangeland pipeline) and signalled an "alarm." The alarm was the first indicator of what was later identified as a release of 462.75 cubic metres (m³) of crude oil from the pipeline into the Red Deer River. The pipeline was off line at the time the alarm was triggered. The pipeline is operated as a "batch" shipment system, meaning that it carries product from multiple production facilities at intervals dictated by the producers.

At 18:00, Plains detected a 6 m³ flow into the pipeline; however, there was no corresponding pressure change downstream. At 18:15, the Plains control room operator began examining the unexplained flow, which included mobilizing personnel to look into mechanical malfunctions and potential release locations. Plains also initiated precautionary closures of several block valves associated with the Rangeland pipeline system in the suspected release area. The control room operator recorded an additional 12 m³ flow at 19:05, indicating a potential problem at or near the Sundre terminal.

A landowner about 5 kilometres (km) downstream of the Rangeland pipeline crossing reported a hydrocarbon odour and an oil sheen on the river. Plains's control centre received this report at 19:34 from the Sundre Petroleum Operators Group (SPOG), and this sighting was the first independent indication of a possible release. At 20:02, Plains issued a pipeline incident notification system (PINS) report² and activated its emergency response plan (ERP).

At 21:57 on June 7, 2012, a sighting by a helicopter contracted by one of several member companies of SPOG who provided assistance during the incident confirmed that the release site was at Legal Subdivision (LSD) 15, Section 10, Township 33, Range 5, West of the 5th Meridian (release site),³ and that the Rangeland pipeline was the source.

^{*} This report is accompanied by many supporting documents. These documents are available from the report's webpage on the AER website, www.aer.ca. For ease of reference, each document cited is identified by a number (e.g., DOC01) to make it easier to locate.

¹ All times in this report are in MDT.

² A PINS report is a Plains report that is e-mailed simultaneously to the company's emergency response staff and its supervisory staff in the event of an emergency.

³ Appendix 7 in Plains's SIR 4 submission (DOC01).

SPOG reported the incident directly to the Alberta Energy Regulator (AER)⁴ Red Deer Field Centre (RDFC) on-call inspector via cell phone at about 19:00 on June 7, 2012. Prior to 19:00, the RDFC experienced problems with its phones. Callers attempting to contact the RDFC got a busy signal. The problem was fixed and the phones were back in service by 21:30.⁵ When the AER established contact with Plains once the spill origin was confirmed after 21:57, Plains provided an estimated release volume between 150 and 500 m³. Plains updated the release volume to 462.75 m³ once a more detailed loss calculation was made,⁶ which the AER accepted. Plains classified the incident as a level-2 emergency⁷ at 22:07.

Det Norske Veritas Canada (DNV) conducted a failure investigation and Acuren Group Inc. (Acuren) performed a metallurgical analysis, which determined that the Rangeland pipeline experienced a full guillotine failure at a circumferential (girth) weld located along the west bank of the Red Deer River. The failure analysis conducted by Acuren as observed by DNV indicated that the pipe failed due to high-cycle fatigue, likely caused by vibrations induced by river flow, and that the section of the pipeline that failed must have been exposed during the incident and was likely uncovered by scour.

Crude oil released from the Rangeland pipeline flowed downstream, affecting several landowners along the watercourse. Glennifer Lake and Carefree Resort communities, located on both sides of the Dickson Dam reservoir (Glennifer Lake) about 40 km downstream of the release site, were also affected. A number of businesses (e.g., rafting tour and recreational fishing and guiding) and landowners were adversely affected upstream of the release as well. At 22:07, Plains assumed responsibility for responding to the incident from SPOG. Plains then confirmed the mobilization of containment and cleanup contractors previously initiated by SPOG and issued a news release on the morning of June 8, 2012.

The upper Red Deer River extends from near the Banff National Park boundary downstream to Glennifer Lake behind the Dickson Dam. It is a wide, braided tributary of the South Saskatchewan

⁴ On June 17, 2013, the *Responsible Energy Development Act* was proclaimed, and the AER was created. Although events may have taken place under its predecessor, the Energy Resources Conservation Board, for simplicity, "the AER" will be used throughout.

⁵ The cause of the problems with the RDFC phone system was not conclusively determined. It was not a result of human error, and cause was attributed to either a network or hardware malfunction. The phone system was replaced and RDFC implemented a protocol to double-check phone connectivity at the end of the day to ensure that even in the event of a network error, callers will have access to the AER.

⁶ More detail regarding the release volume calculation is included later in the report. 462.75 m³ was accepted by the AER in September 2012 once the line was evacuated and segments removed for analysis.

⁷ The Assessment Matrix for Classifying Incidents (appendix 4 of *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*) was used to determine the emergency level.

River and is one of Alberta's most popular rivers for recreational use, also supplying municipal and industrial demand. The river passes through a number of Alberta's ecoregions.⁸ At the crossing where the failure occurred, the river winds through agricultural land and is considered a Class C fish habitat.⁹

The river's seasonal flow is usually 20 to 30 cubic metres per second (m^3/s). However, the day before the June 7 release (June 6, 2012, at 13:30), the recorded flow peaked between 950 and 1000 m^3/s . At the time of the incident, the flow was recorded between 500 and 600 m^3/s .¹⁰ The Government of Alberta issued a high streamflow advisory and flood warnings for the Red Deer River on June 5 and June 6, 2012.¹¹

AER investigators visited the failure site and Sundre control centre to collect information and launch an investigation. AER investigators took pictures, recorded events, collected information, and reviewed available reports and other documentation.

2 Pipeline Specification, History, and Monitoring

The Rangeland pipeline, licence number 5844, is composed of carbon steel and is externally coated with coal tar or polyethylene tape (various sections). At the subject river crossing, the pipeline is coated with polyethylene tape overlain with a shotcrete weight coat. The pipe is 323.9 mm (12 inches) in diameter and is manufactured to American Petroleum Institute (API) Standard 5LX, Grade X46 pipe standards. The pipeline's licensed maximum operating pressure is 9930 kilopascals (kPa).

The pipeline transports light, high-sulphur-content (>0.5 weight %) crude oil and runs about 305 km from the Plains Sindre terminal through the town of Cochrane to Pincher Creek, Alberta. The pipeline has a predominant wall thickness of 4.78 mm, with a wall thickness of 7.92 mm at the subject river crossing.

^b Alberta Agriculture and Rural Development, *Agroclimatic Atlas of Alberta* ([http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/aag6278](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/aag6278)).

⁸ The Government of Alberta *Fish Habitat Manual* describes a Class C fish habitat as of moderate sensitivity (i.e., sensitive enough to be potentially damaged by unconfined or unrestricted activities within the water body). Broadly distributed, Class C fish habitat supports local fish species populations.

¹⁰ AER attachments appendix 1. "Government of Alberta Stream Flow Chart for Red Deer River below Timber Creek" (DOC02).

¹¹ AER attachments appendix 2, ESRD High Streamflow Advisory and 2a, ESRD Flood Watch (DOC03).

The pipeline was constructed in 1966 and was originally licensed to Hudson's Bay Oil and Gas Company. The pipeline system changed ownership at various times from 1966 to 2006. Plains acquired the pipeline system from Rangeland Pipeline Company (RPC) in November 2006.

In 1966, pipeline installation practices for water crossings involved an "open cut" trenching method to lay the pipeline across the watercourse. The installation standard in effect at that time was the United States American Standards Institute *B31.4-1966: Liquid Petroleum Transportation Piping Systems*), published by the American Society of Mechanical Engineers. This standard did not prescribe a minimum depth of cover. However, the standard did state in section 434.14.1 that "river crossings are individual problems and the designer shall investigate composition of the river bottom, variation in banks, velocity of stream, scouring, and special seasonal problems."¹² This is discussed in more detail in section 5.1 of this report.

The original depth of cover for the Rangeland pipeline at the time of construction is not known. In 2004, prior to Plains's acquisition of the pipeline, a profile with depth-of-cover measurements along the Red Deer River crossing at the release location was conducted.¹³ However, as a result of flooding in June 2005, the west bank of the river at the subject crossing eroded and the line became exposed. Prior to Plains's purchase of the pipeline, RPC retained the services of Northwest Hydraulic Consultants (NHC) to conduct an assessment of the river and provide recommendations for remediation of the exposed pipeline.¹⁴ One of the options proposed by NHC was to install rock groynes in the watercourse upstream and downstream of the pipeline to aid in mitigating scour and bank erosion during flood conditions. Information provided to the AER indicates that RPC installed rock groynes in response to NHC's recommendation.

By letter dated September 29, 2008, the AER requested that Plains conduct a river crossing survey, including depth-of-cover measurements, and a hydraulic review. Plains submitted the results to the AER on November 24, 2008. In September and November 2011, Plains commissioned a water crossing inspection that included the crossing where the release occurred; however, swift water conditions prevented a complete inspection.

¹² USAS B31.4 Liquid Petroleum Transportation Piping System (1966), section 434.14.1, River and Stream Crossings.

¹³ Appendix 34, page 14, in Plains's November 26, 2012, response (DOC05); Appendix 7 in Plains's SIR 1 submission (DOC06).

¹⁴ Appendix 6 in appendices from Plains's response dated November 26, 2012 (DOC04).

As required under the Canadian Standards Association *CSA Z662: Oil and Gas Pipeline Systems*, Plains maintained an integrity management program¹⁵ and a pipeline integrity management manual.¹⁶

Plains uses SCADA systems technology on all of its pipeline systems. This allows for continuous electronic monitoring and control of pipeline systems from dedicated computer consoles located in Plains's control centre.

3 Response and Control

The June 7, 2012, events at the release site and at the control centre are summarized in table 1. The chronology was compiled using the SPOG call log,¹⁷ Plains's chronology of events, and Plains's Olds control centre operator console logs.

Table 1. Chronology of events on June 7, 2012

Time	Source	Description
17:41	Plains	Initial low pressure reported after pumps M5 and M6 ¹⁸ at Plains's Sundre terminal triggers a SCADA system alarm, which is detected at Plains's control centre in Olds. In addition, a meter (downstream of the pumps) reports a flow of 6 m ³ into the pipeline; however, the pipeline is off line. Plains's operator station logs indicate a suspected valve leak at its Sundre terminal.
18:15	Plains	The control room operator tells the on-call field operator to go to the Sundre terminal and investigate. The on-call field operator called a second operator to respond on his behalf as his estimated time of arrival was about 45 minutes.
18:50	SPOG	A resident calls the SPOG contact line to report a hydrocarbon odour and oily sheen on the Red Deer River downstream from the release location.
18:55	SPOG	SPOG calls the RDFC and receives a busy signal. Immediately after, SPOG calls the on-call AER inspector directly.
18:58	SPOG	SPOG begins calling individuals, municipal and regulatory contacts, and industry members. (The SPOG call log indicates a total of eight member companies were contacted and most respond with field personnel.)
19:05	Plains	Plains's metering measures an additional 12 m ³ of product entering the pipeline, further indicating a problem at the Sundre terminal.
19:08	Plains	Plains's control room and operations staff begin closing pipeline valves in the Sundre terminal area.
19:25	SPOG	SPOG contacts Plains to inform it of a possible release.

¹⁵ The Canadian Standards Association defines an integrity management program as a documented program that specifies the practices used by the operator to ensure the safe, environmentally responsible, and reliable service of a pipeline system.

¹⁶ Appendix 31 in appendices from Plains's response dated November 26, 2012 (DOC07).

¹⁷ AER attachments appendix 7, SPOG Call Log (DOC08).

¹⁸ AER attachments appendix 4, Flow Diagram (DOC09).

Time	Source	Description
19:27	SPOG	SPOG member companies Bonavista Energy Corporation (Bonavista) and Pennwest Petroleum Ltd. respond to a suspected release into the Red Deer River.
19:34	Plains	SPOG calls Plains's Olds control centre to indicate that a landowner reported a hydrocarbon odour and oily sheen on the Red Deer River downstream of the subject crossing.
19:40	SPOG	Shell Canada Ltd. reports crude oil sheen on Red Deer River back water at NE-35-033-05W5M.
19:44	SPOG	Oil reported at LSD 15-35-033-05W5M (licensed to Bonavista). Appears that the oil originated from a Bonavista site. Bonavista responds at this time.
19:45	SPOG	Apache Canada Ltd. hires a helicopter and reports that it is en route.
19:50	SPOG	Bonavista contacts Environment Canada (reference no. 259270).
19:54	SPOG	SPOG receives a telephone report (unidentified caller) of a strong hydrocarbon odour at Highway 587 and Range Road 50 (about 16.5 km north-northeast of release site).
20:02	Plains	Plains issues a PINS report to several of its emergency response and management staff members.
20:14	Plains	Plains closes valves immediately upstream of meters measuring flow into the pipeline; flow count indicator is now zero.
20:15	SPOG	Alberta Health Services reports as en route to the release site.
20:19	SPOG	SPOG contacts the Western Canadian Spill Services (WCSS) oil spill cooperative for the area to deploy equipment.
20:20	SPOG	A responding SPOG representative notices an odour in the Garrington area (about 19 km north-northeast of the release location). SPOG notifies Red Deer Central Region Disaster Services.
20:27	SPOG	SPOG contacts Sundre Disaster Services to confirm that Sundre's water supply is from a freshwater source well and not the Red Deer River.
20:35	SPOG	SPOG contacts HSE Integrated Ltd. (HSE) to dispatch an air monitoring unit (AMU) from Red Deer.
20:50	SPOG	Bonavista personnel confirm that its site is not the source of the release. Resident calls indicating his wife was sent to the hospital.
20:56	SPOG	SPOG calls Sundre hospital and commits to keep them informed.
21:00	SPOG	Response equipment from the local WCSS oil spill cooperative and an HSE AMU are dispatched to Dickson Dam.
21:03	Plains	Helicopter surveillance indicates that leak point of entry may be at the Jackson Creek tributary.*
21:05	Plains	Plains establishes an incident command centre at the Olds control centre.
21:05	SPOG	Plains confirms that all lines are shut in and SCADA system shows no pressure loss.
21:13	SPOG	Helicopter surveillance by a SPOG member confirms that the leak is from Plains's Rangeland pipeline at LSD 15-10-033-05W5M; confirmation communicated to SPOG.
21:40	SPOG	Helicopter surveillance provides further confirmation of the source of the release and reports that the oil sheen is past Garrington area (bridge on Highway 587 about 19.5 km north-northeast of the release location and about 4 km due west of Garrington area).
21:40	Plains	Plains contracts SWAT Consulting Inc. (SWAT) and confirms that WCSS equipment and personnel have been mobilized.
21:57	Plains	Plains acknowledges receiving aerial confirmation that the leak is at its Rangeland pipeline.
22:07	Plains	Plains classifies the incident as a level-2 emergency.

Time	Source	Description
22:10	SPOG	Plains confirmed the release was from its pipeline. SPOG sends an Emergency Communication Alert to residents confirming the release, listing initial response activities, and providing contact information for questions or concerns.

* The initial report of the Jackson Creek tributary as being the possible point of release caused confusion with responding SPOG member companies (including Plains), responding regulatory agencies, and the media.

The time between the initial alarm in Plains's Olds control centre at 17:41 and classification of the incident as a level-2 emergency at 22:07 was four hours and twenty-six minutes. The total time from the initial alarm to when it appeared that the flow was stopped (20:14 after closing valves upstream of meters) was two hours and thirty-three minutes. During this time, most of the initial response efforts appeared to be coordinated through SPOG until it was confirmed that the release originated from the Rangeland pipeline.

After it declared the incident a level-2 emergency and activated its ERP, Plains initiated response efforts, which included setting up an emergency operations centre in Plains's Calgary office and activating an incident command post initially at the Cottonwood Hall and then later relocated to the Cottonwood Day Use Area at the southwest end of Glennifer Lake. Plains also confirmed the previous mobilization of Western Canadian Spill Services (WCSS) equipment by SPOG members, including river booms, soaker pads, pumps, skimmers, and associated equipment. Plains contracted SWAT Consulting Inc. (SWAT) to lead response and spill recovery efforts on the Red Deer River and Glennifer Lake.

Five containment booms with skimming and oil recovery equipment were located on Glennifer Lake. Plains shut down all of its pipelines in the release area as a precaution and also contracted third parties to conduct the following control measures:

- establish a logistics team to mobilize supplies, services, and equipment;
- deploy a spotting team to detect sheen downstream of the Dickson Dam;
- request closure of water intakes downstream of the release;
- notify residents and general users downstream of the incident;
- deploy booms and establish teams to monitor effectiveness continuously;
- temporarily close access to Glennifer Lake;
- establish security access points; and
- identify all affected nearby stakeholders, including transients.

On June 9, 2012, at 15:00, Plains installed a Stopple® pipeline isolating device (Stopple) on the west side of the Red Deer River (Plains's Sundre terminal side) to further isolate the leak. The Stopple was installed and pressure tested by June 10, 2012. Once the source was controlled, the

pipe contents evacuated, and the release contained, the AER and ESRD consulted with Plains, and the incident was downgraded to an alert level on June 19, 2012, at 14:30.

Plains established a resident information centre at the James River Community Centre where affected landowners, recreational users, and residents around Gleniffer Lake could ask questions of Plains, SPOG, and the AER and Alberta Health Services (AHS), as well as other regulatory and municipal agencies. Plains worked with community leaders, MLAs, local authorities, and regulatory agencies to help develop measures to mitigate impacts, including

- potable water delivery and water quality testing programs,
- signs at boat launches indicating where cleanup operations were ongoing,
- a community response phone line and e-mail address for concerns and questions, and
- a website with detailed response information, including maps, photos, and videos.

During peak response activities on June 26, 2012, the total daily count of individuals participating in cleanup and response operations was 338. The daily average worker count was 290 in June and about 260 in July and the first two weeks of August (not including regulatory or municipal officials).

3.1 Regulatory Response

Several Alberta regulatory agencies were involved and, in some instances, had representatives present at the site. Staff from the AER were involved throughout the incident. They provided ongoing direction and advice to Plains, particularly in the early stages of the incident. Direction from AER representatives to Plains was necessary to ensure continued communication with the public and media.

The following provincial and federal agencies were notified of the incident by either SPOG or Plains within 24 hours after the incident was classified as a level-2 emergency:

- The AER
- The Alberta Emergency Management Agency (AEMA)
- Alberta Health Services
- Department of Fisheries and Oceans Canada
- Environment Canada
- ESRD
- The RCMP
- Alberta Tourism, Parks and Recreation

The following municipal authorities and water services were notified of the incident by either SPOG or Plains within 24 hours after the incident was classified as a level-2 emergency:

- City of Red Deer
- City of Red Deer Environmental Services Department – Water Quality
- Clearwater County
- Mountain View County
- Mountain View Regional Services Water Treatment Plant
- Red Deer County
- Sundre Fire Department
- Town of Sundre

Within 24 hours after the incident was classified as a level-2 emergency, either SPOG or Plains also notified the following:

- The Red Deer County auto-call-down system
- Carefree Resort on Glennifer Lake
- Glennifer Lake Resort
- SPOG emergency communications automated phone alert to area residents

On June 7, 2012, at about 22:00, field centre staff set up an emergency operations centre at the RDFC. On the morning of June 8, 2012, the AER and AEMA elevated the Provincial Operations Centre (POC) to an operational level 3 and implemented the Petroleum Industry Incident Support Plan (PIISP).¹⁹ The AER established an emergency operations centre at the AER's Calgary head office to assist in coordinating incident support.

The AER and ESRD established a unified regulatory / lead agency structure because the spill entered a river that provides water resources for municipal, agricultural, and industrial users and to coordinate Government of Alberta communications. SPOG also played a significant role in the early stages of the incident by coordinating the emergency phone call notifications to regulators and stakeholders once the spill into the river had been identified.

¹⁹ The POC typically operates at a level 1 (routine province-wide monitoring), but in the event of an emergency can elevate to an operational level 4.

Due to the significant impact of the incident to the many landowners along the watercourse, residents at the Glennifer Lake Resort and Carefree Resort communities, as well as several business up- and downstream of the release, communications with stakeholders was complex for Plains, SPOG, and responding agencies. The spill received media attention on a global scale. On Friday, June 8, Alberta Premier Alison Redford and Minister of Environment and Sustainable Resource Development Diana McQueen visited the Glennifer Lake site and held a press conference.

NavCanada's Edmonton Flight Information Centre issued a Notice to Airmen (NOTAM) at the AER's request on June 8, 2012. This was done to ensure control and safety of the airspace from the spill location to Glennifer Lake for responding personnel and authorized flights. The NOTAM ceiling was 475 m (1500 feet). The NOTAM was rescinded at 16:00 on June 15, 2012.

On June 19, 2012, at 14:30, the incident was called down from a level-2 emergency and reclassified to an alert level, and the POC went from level-3 to level-1 status and the PIISP was deactivated. At that time, ESRD assumed responsibility as the environmental lead agency, with the AER providing support by ensuring that Plains complied with waste disposal and pipeline evacuation requirements and by supervising other AER-regulated activities.

3.2 Recovery

As indicated earlier in this report, as part of its response to the incident, Plains installed a Stopple 200 m upstream of the release location (west side of the Red Deer River). The Stopple installation was to further isolate the line and to aid in removing the oil remaining in the pipeline.

After the pipeline was isolated, Plains used a two-phase approach to remove the east and west portions of the pipe (upstream and downstream of the failed weld). Phase one involved installing a cofferdam to isolate the failed pipe, and any oil in the pipe, from the river. The cofferdam was used to facilitate cutting a section (including the failed weld) from the pipeline and install a cap on the open end of the pipe. Phase two involved removing the remaining downstream section of the pipe for analysis. (The pipe kinked and shifted with the river current downstream of the original crossing, about 29 m from the failure location.) The cofferdam was also used as a working platform to access the remaining section of pipe. A steel container was placed over the remaining pipe in the river. Inside the container, a Stopple and three taps were installed to help flush and cut this section of pipe.

The Rangeland pipeline segment crossing the Red Deer River was removed and has not been replaced. To enable the continued movement of oil across the Red Deer River through the Rangeland system, on July 19, 2012, the AER approved the construction of a "jumper" (a short section of pipe connecting two pipelines). The jumper section would connect Plains's 168.3 mm (6 inch) Harmatten-to-Sundre pipeline to the NPS 12 Rangeland pipeline at a block valve located at mile post (MP) 212, with final delivery into the Hartell terminal. Related to this approval, Plains

submitted applications for a substance/product change and a line split and reversal in July 2012. On July 19, 2012, the AER approved these changes.

The AER required Plains to suspend the remaining pipeline from the river up to the block valve at MP 212. Plains plans to replace the failed section under the Red Deer River by directionally drilling several metres under the river and installing a new pipeline. Plains, however, cannot conduct these activities unless it receives all necessary regulatory approvals.

4 Environmental Response

The incident and related response and remediation efforts caused impacts to wildlife, water, soils, and vegetation. Jurisdiction over those matters currently resides with other regulatory agencies (i.e., ESRD, Environment Canada, and the Department of Fisheries and Oceans Canada), this report does not include a detailed description of those impacts and the related regulatory response.

The AER is responsible for all oilfield waste management and disposal in accordance with *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*.

Plains developed a clean-up plan in collaboration with ESRD, with all waste management and disposal directed and approved by the AER. Shoreline cleanup operations included deployment of several strike teams to clean up oil with absorbent booms and soaker pads, collecting and bagging contaminated vegetation and woody debris, wiping vegetation, and washing and flushing shorelines with fresh water. Plains contracted Tervita Corporation (Tervita) to handle all oily waste generated from the spill. All waste generated from skimming operations and shoreline cleanup was hauled to the Medicine River Oil Recyclers.

4.1 Air Monitoring

Air monitoring following the incident was supervised by both the AER and ESRD.

On June 8, 2012, air monitoring units (AMUs) were set up at Glennifer Lake Resort, Carefree Resort on Glennifer Lake, and near the release location. On June 9, 2012, Plains submitted an air monitoring plan to the AER and ESRD. As cleanup and remediation continued, additional units were set up at NE-35-033-05W5M on June 11, 2012, and the Bracken Gravel Pit on June 13, 2012. The AER and ESRD deployed an AMU and mobile air monitoring lab, respectively, to the incident area on June 8, 2012. No hydrogen sulphide (H₂S) readings or air quality issues were detected. On June 10, 2012, both units were released. AMUs contracted by Plains were demobilized gradually while cleanup activities progressed. The last AMU was removed August 22, 2012.

Air monitoring results obtained by Plains's contractor, Trojan Safety Services Inc., were reported regularly through Plains's regulatory updates. No exceedances to the Alberta Ambient Air Quality Objectives were reported at any time during clean-up operations.

5 Pipeline Failure Root Cause Analysis

As part of its investigation, the AER used a root-cause analysis to determine what happened, how the event occurred, and why conditions leading up to the event existed. Root causes are defined as

- specific underlying causes that can be reasonably identified,
- causes over which responsible parties (licensees) have control, and
- causes for which effective mitigation measures can be established.

The AER considered two aspects of the Rangeland pipeline failure in its assessment of root causes: failure of the pipeline and the quantity of crude oil released as a result of the failure.

5.1 Pipeline Failure Root Cause

The AER has determined that the failure of the Rangeland pipeline was caused by a combination of the following:²⁰

- infrequent inspections of the river crossing, not in line with Plains's Integrity Management Program (section 1.3.9.1.2),
- failure by Plains to inspect the pipeline annually as required by section 43 of the *Pipeline Rules*,
- failure by Plains to take necessary action with respect to scour hazards identified by previous inspections of the release site,
- failure by Plains to apply appropriate mitigation measures in accordance with its own hazard assessments, and
- failure by Plains to take steps necessary to ensure that the pipeline remained in a safe condition during a period of increased water flow and scour potential.

5.2 Plains's Reported Release Volume

Plains initially estimated the release volume between 150 and 500 m³. Subsequently, Plains estimated a crude oil release volume of 462.75 m³ based on a metered volume difference.

²⁰ AER attachments appendices 6, Fish Bone Diagram (DOC10).

Based on the AER's review of the incident chronology, it appears that when the pipeline severed in the river, the volume metered into the pipeline between the 17:41 alarm and the block valve closures (BVs 51 and 53) upstream of the meters at 20:14 was released into the river. Based on topography downstream of BV 212, it is likely that some backflow also entered the river before Plains closed BV 212 at 20:53.

The estimated release volume is based on SCADA information indicating that the Rangeland pipeline was off line and not pumping at the time of the incident.

Based on the above information, the AER has concluded that, due to the pipeline elevation profile and topography of the site, gravity and river flow contributed to the volume of product released. It is unknown if the failure began as a small leak that later developed into a full circumferential failure. The time it took for Plains to install the Stopple on the west side of the river and engage the block valves also increased the volume of oil released into the Red Deer River.

6 Investigation Findings Regarding Pipeline Failure

Following the incident, AER staff reviewed its own incident reports and records, incident reports filed by Plains, and detailed reports prepared at the direction of the AER by experts contracted by Plains. The following summarizes the key findings and observations regarding the incident.

6.1 Summary of Plains's Findings

In 2004, and prior to the acquisition of the Rangeland pipeline by Plains, the previous operator (RPC) commissioned Midwest Surveys to conduct depth-of-cover measurements along the Red Deer River crossing at the release site.²¹ The survey started approximately 860 m northwest of the west bank of the Red Deer River along the pipeline right-of-way. The pipeline depth of cover was measured from this point and along the entire river crossing. The profile identified a depth-of-cover measurement of 1.29 m within the main channel of the river crossing close to the west bank. This point along the pipeline was referred to as at 0 + 876.11 metres above sea level (masl).²²

In 2005, the Red Deer River experienced significant flooding that eroded the river banks and exposed portions of the pipeline along the west bank of the river. Following the exposure, a report was furnished to RPC by NHC on March 24, 2006, which detailed a number of remedial options to

²¹ Appendix 34, page 14 in appendices from Plains's response dated November 26, 2012 (DOC05); Appendix 7 in Plains's submission SIR 1 (DOC06).

²² Appendix 36 in appendices from Plains's response dated November 26, 2012 (DOC11).

be considered to address the exposed crossing and to control bank erosion. The NHC report recommended three options, including rock armouring, rock groynes, and armourflex.²³

NHC indicated on page 2 of the report that any remedial option should be guided by the following considerations:

- minimize the amount of river bed excavation (habitat) encroached upon remedial structures;
- to the degree possible, re-establish the edge of the bank alignment that existed prior to the 2005 flood;
- minimize the enhancement of scour potential over the pipeline that a protective structure might produce;
- must provide 100-year flood protection for long-term protection.

In consultation with EnviroMak Inc., of the three options considered, the installation of rock groynes was chosen by RPC.²⁴ Subsequently, RPC installed rock groynes at the subject crossing.

In November 2006, and after installation of the rock groynes, Plains acquired the Rangeland pipeline from RPC.

By letter dated September 29, 2008,²⁵ the AER required Plains to conduct a river crossing survey, with depth-of-cover measurements, as well as a hydraulic review and to provide the results to the AER. In October 2008, Plains conducted the survey with depth-of-cover measurements and submitted the results to the AER on November 24, 2008.²⁶ The survey included a hydraulic review by NHC.²⁷ The 2008 survey indicated a depth-of-cover measurement of 0.84 m at 0 + 876.62 masl. By contrast, the prior survey conducted by RPC in 2004 identified a depth of cover of 1.29 m at 0 + 876.11 masl.²⁸

²³ Appendix 6 in appendices from Plains's response dated November 26, 2012 (DOC04).

²⁴ Appendix 7 in appendices from Plains's response dated November 26, 2012 (DOC12).

²⁵ This request came after the Pembina pipeline failure into the Red Deer River in June 2008. AER attachments, appendix 5, appendices 5 (DOC13).

²⁶ AER attachments appendix 5a, appendices 5 (DOC14).

²⁷ Appendix 4 in Plains's submission SIR 1 (DOC15).

²⁸ Appendix 36 in appendices from Plains's response dated November 26, 2012 (DOC11).

The hydraulic review conducted by NHC on behalf of Plains dated November 21, 2008, made the following observations and conclusions:²⁹

- The permanent installation of the 30 m rock spurs in 2006 was generating some cover with respect to the previously exposed portion of pipeline in 2005; observations at the time showed the spurs exhibited no signs of damage.
- The remainder of the river crossing remained exposed to the risk of bed scour.
- A 55 m length of pipeline at elevation 1074.0 masl near the end of the spurs was at greatest risk of exposure at the time.
- There was no way to indicate whether the pipeline had become exposed for a short time within this 55 m length during past floods, frequent monitoring was required.

On September 9, 2011, Plains contracted BGC Engineering to perform a water crossing inspection at the release site. The report of that inspection included the following observations and recommendations:³⁰

- A minimum depth of cover measured (actual) was 1.3 m, however a lower depth of cover was suspected in the talweg.³¹ The inspection indicated that a complete survey with measurements in the talweg could not be performed due to swift water conditions.
- It was recommended that the crossing be revisited in late fall in order to assess bed protection along the entire width of the river.
- If unable to wade during next ground inspection, commission a survey of the crossing to obtain a complete profile of the pipeline across the river.

On November 3, 2011, Plains contracted BGC Engineering to perform a further water crossing inspection at the release site. The report of that inspection included the following observations and recommendations:³²

- Swift water conditions were similar to previous inspection in September 2011.

²⁹ Appendix 4 in Plains's submission SIR 1 (DOC15).

³⁰ Appendix 6 in Plains's submission SIR 1 (DOC16).

³¹ The line connecting the lowest or deepest points along the length of a stream or river bed or valley.

³² Appendix 34 in appendices from Plains's response dated November 26, 2012 (DOC05), and appendix 6 in Plains's submission SIR 1 (DOC16).

- Recommended that a detailed survey be completed as identified in the September 2011 inspection. As conditions were similar to the previous inspection, a complete profile of the crossing was recommended.
- Given the size of the river, a survey should be conducted on a periodic basis.

6.2 Analysis by Acuren

Acuren was commissioned by ESRD to conduct a failure analysis and to provide its findings to ESRD. On August 13, 2012, the upstream segment of pipe was removed from the river. ESRD seized the section of pipe and transported it to Acuren's laboratory in Edmonton, Alberta. On August 27, 2012, the downstream end of the pipeline was removed from the river and delivered to Acuren's Edmonton laboratory.

A full report was completed by Acuren and was made available to the AER subject to certain trust conditions imposed by Alberta Justice. The AER Law Branch reviewed the trust conditions and determined that the conditions attached rendered the report unusable for the AER investigation. The AER Law Branch subsequently returned the report to Alberta Justice. Consequently, this report does not contain any reference to or base any findings or conclusions on the Acuren report.

6.3 Failure Investigation by DNV

Plains retained the services of DNV to assist with the failure investigation in connection with the incident. On September 5 and 6, 2012, DNV visited Acuren's metallurgical testing laboratories in Edmonton and witnessed the metallurgical examination and analysis of both failed pipe sections on behalf of Plains. DNV subsequently released a report regarding its observations of Acuren's analysis dated November 23, 2012. DNV's report included the following observations and conclusions:³³

- The failed section of pipe met all applicable requirements for the standard at the time of manufacturing for API Standard 5LX, Grade X46 pipe standards, and the current *CSA Z245.1-07*.
- Mechanical testing could not be conducted on the weld responsible for the release as it had completely failed.
- The analysis indicated that the pipe failed due to high-cycle fatigue, likely caused by vibrations induced by river flow.

³³ Appendix 8 in appendices from Plains's response dated November 26, 2012 (DOC17).

- The failure occurred as a result of a high-cycle fatigue crack initiated at the toe of the root of the weld on the inside surface of the pipe, near top dead centre.
- For this to occur there must have been an exposed length of pipe, likely uncovered by scour.
- There were small cracks observed at the toe of the root and cap passes of the girth weld, but these cracks did not appear to play a role in the initiation of the crack that ultimately led to the failure.

6.4 AER Findings

Failure analysis indicates that the Rangeland pipeline failed due to high-cycle fatigue, likely caused by vibrations induced by river flow. A section of the Rangeland pipeline must have been exposed at the time of failure, likely caused by scour. The reported release volume of 462.75 m³ of crude oil into the Red Deer River occurred because of gravity drainage and river flow combined with the pipeline contents not being isolated at a point close to the break.

In November 2008, Plains contracted NHC to inspect the release site. NHC's report dated November 21, 2008, indicated the following:³⁴

- "The remainder of the river crossing remains exposed to the risk of bed scour."
- "There is no way to indicate whether the pipeline has become exposed for a short time within this 55 m length during past floods. The situation requires frequent monitoring."

In addition to information quoted in the NHC report above, Plains's own risk assessment³⁵ categorized the risk of wash-out erosion as high, Plains did not apply any additional measures to reduce the likelihood or consequence of failure.

- The AER concludes that Plains failed to apply appropriate mitigation measures in accordance with its own hazard assessment.

Plains's Pipeline Integrity Management Manual requires inspections of its pipeline water crossings. The manual indicates that Plains will inspect for exposed piping, measure depth of cover over submerged piping, and assess erosion, scour potential, and bank slope stability on an annual basis.³⁶ Plains completed inspections of the release site in November 2008 and September 2011.

³⁴ Appendix 4 in Plains's submission SIR 1 (DOC15).

³⁵ Appendix 9 in Plains's submission SIR 1 (DOC18).

³⁶ Appendix 31 in appendices from Plains's response dated November 26, 2012 (DOC07).

- The AER finds that Plains failed to complete inspections at the required frequency in accordance with its own integrity management program.
- The AER finds that Plains failed to apply appropriate mitigation measures in accordance with its own assessment that the release site was at risk of bed scour.
- The AER finds that had Plains heeded recommendations made at the time of the inspections conducted in fall 2011, and isolated, cleaned, and purged the section of the Rangeland pipeline that crosses the Red Deer River in light of streamflow and flood warnings issued by the Alberta government the day before the incident, the release may have been prevented entirely or, if not prevented, the volume of fluid released from the pipeline would have been significantly reduced.

7 Other Investigation Findings

Because the incident occurred in a rural area with multiple land uses, including agricultural and recreational activities, and with multiple members of the public potentially affected, communication and engagement with stakeholders was challenging, especially in the early stages.

Plains took many steps to engage the local community and provided regular updates in a variety of ways. There were some complaints from residents along the Red Deer River about the delay by Plains to communicate with them directly. However, Plains took steps to address those concerns in the days following the incident.

Plains did not initially intend to hold community meetings. However, it agreed to do so at the insistence of the AER. Generally, these meetings were very positively received by the local community.

Plains took numerous steps to keep the media informed, particularly during the first week, making senior executives available for media interviews and scheduling regular media updates. However, AER staff had to direct Plains to maintain these activities after the first week. Plains complied with this direction.

Overall, Plains's communication efforts resulted in adequate information reaching a large number of people in an efficient manner. However, the flow of information was not always consistent and there were times when the information was confusing or difficult to obtain. Further, on several occasions, AER staff had to prompt and insist that Plains provide information to and communicate with stakeholders in connection with the incident.

8 Noncompliance with AER Requirements

On July 4, 2013, the AER issued four High Risk Enforcement Actions against Plains in connection with the above findings.

8.1 Noncompliance with the *Pipeline Rules*

Section 9 of the *Pipeline Rules* requires pipeline licensees to comply with CSA Z662. The AER determined that Plains failed to comply with section 43(1) of the *Pipeline Rules*, which requires licensees to annually inspect pipelines that cross water or unstable ground. In addition, clause 10.6.1 of CSA Z662 provides further detail with respect to pipeline patrolling. The AER finds this noncompliance to be particularly troubling as the three most recent inspections indicated a pipeline at risk.

The AER also determined that Plains failed to comply with clause 10.3.1.1 of CSA Z662, requiring operators who become aware of conditions that may lead to failures to conduct an engineering assessment to determine suitability of continued service.

8.2 Noncompliance with *Directive 071*

On May 1, 2013, AER Emergency Preparedness and Audit Section staff audited Plains's ERP. The audit determined that Plains did not comply with *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*. The AER issued two High Risk Enforcement Actions in relation to noncompliances with *Directive 071* on July 4, 2013.

The AER determined that Plains failed to comply with section 14.6 of *Directive 071* requiring licensees to review and update their ERP. Plains also failed to conduct a public awareness program with residents in the emergency planning zone associated with this pipeline.

Plains has appealed three of the four High Risk Enforcement Actions issued by the AER in connection with the incident. The AER is currently processing the appeals in accordance with *Directive 019: Compliance Assurance*. Decisions will not be made until the investigation report is released.

9 Requirements and Recommendations

The AER recommends (indicated by "should") and requires (indicated by "must") the following:

9.1 Requirements for Industry

- 1) Pipeline licensees and operators who identify pipeline risks that can lead to failure must reduce or eliminate the risk through engineering (clause 10.3.1.1 in CSA Z662).

- 2) If a pipeline licensee or operator identifies a potentially significant risk to the public, environment, or property (in this case flowing water), all attempts to reduce or eliminate a failure must be considered (clause 3.1 and annex N in CSA Z662).
- 3) Where relevant information is not available, operators must conduct inspections or testing, or make conservative assumptions that can be supported by rational analysis and valid system experience, to enable an engineering assessment to be carried out and risks and environmental impacts to be minimized (clauses 3.3.3.2 and 3.3.3.3 of CSA Z662).

9.2 Recommendations and Requirements for Plains

- 1) At the time of the incident, the risks of a washout and bed scour at the subject river crossing were high. Consequently, Plains must develop, implement, and communicate procedures to isolate, clean, and purge its pipeline during high seasonal flow. Plains should also address the long-term integrity of the pipeline crossing by replacing the river crossing pipeline sections with a directionally drilled crossing or further protecting the remaining crossing outside of the current groynes using similar methods. In doing so, Plains must also ensure that it complies with applicable provisions of the *Water Act* (*Water Ministerial Regulation* and the *Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body*).

- 2) During the inspections conducted by BGC Engineering on behalf of Plains in September and November 2011, inspectors could not determine the depth of cover for the entire crossing. Although adequate information about depth of cover was not obtained for the entire crossing, Plains continued to operate a pipeline that was considered at risk at the subject crossing due to high seasonal flow or flood conditions.

As per CSA Z662, in situations where exact depth of cover information is not available, Plains was required to develop, implement, and communicate procedures that assume the worst case scenario (exposure of pipeline) until clear and verifiable information on depth of cover can be obtained. Plains must take all steps necessary to ensure compliance with this requirement.

- 3) A block valve existed a few hundred metres to the south and east of the river, but the next block valve upstream was at the pump station about 14 km away. A Stopple was required to limit gravity drainage towards the river and to control and contain the release. The location of the block valves at this crossing location was clearly not sufficient to mitigate the risk and minimize the impact of the incident. CSA Z662, clause 4.4.8, requires licensees to install valves on both sides of major water crossings in order to limit damage from accidental discharge. Plains must reassess all of its pipeline water crossings to ensure that all isolation valves are appropriately located and operated in a manner that complies with this requirement.

In addition, Plains must implement, document, maintain, and communicate to all applicable staff policies and procedures outlining when and in what circumstances isolation valves must

be activated (e.g., immediately following warnings of increased streamflow). Plains must also take every step necessary to ensure that its staff comply with these policies and procedures at all times.

- 4) In relation to the June 7, 2012, Rangeland pipeline incident, Plains's participation and interaction with the local mutual aid cooperative SPOG was deficient. Plains relied on other SPOG members for initial incident response and to locate the pipeline failure. Plains should become more actively involved in local synergy groups and mutual aid organizations in all areas where it operates (including SPOG).

9.3 AER Follow-up

- 1) Because of concerns relating to deficiencies in Plains's communications with stakeholders about the incident, the AER should consider its role in engagement and communications activities with licensees to ensure that information is disseminated as efficiently as possible. This should include
 - a) considering the need for staff from the Office of Public Affairs to be on site until the AER has indicated that their presence is no longer required,
 - b) considering the need for a protocol that requires a news release be issued once an incident is considered over, and
 - c) considering the need for protocols for operators and AER personnel to coordinate public announcements with responding partners, such as AHS, ESRD, the AEMA, and municipal authorities, during an incident to manage information dissemination.
- 2) The AER should audit Plains's emergency response and integrity management plans. In its order dated July 4, 2013, issued under section 22 of the *Oil and Gas Conservation Act*, the AER stated that it will perform a full audit of Plains's operations regarding emergency planning and response, safety and loss management systems, risk assessment and mitigation, communications and stakeholder relations, regulatory reporting, and progress in connection with action plans required in response to enforcement.
- 3) The AER will follow up with Plains on sections 9.2.1, 9.2.2, and 9.2.3 within 90 days of the issuance of this report.
- 4) The RDRC Community Relations team will follow up with Plains on section 9.2.4 within 90 days of the issuance of this report.

Appendix 1 Glossary of Terms

cofferdam	A watertight structure (water dam) that encloses an area under water (in this case in the watercourse) and is pumped dry to enable construction work to be carried out.
off line	Refers to a pipeline pump in an "off" position, but the valve is open.
Petroleum Industry Incident Support Plan	A provincial-level plan that directs Government of Alberta operations in supporting a local authority, a licensee, or an operator during an emergency.
Provincial Operations Centre (POC)	The POC serves as a provincial communication and response coordination centre that is staffed 24 hours a day, 7 days a week. The POC is a central point for the collection, evaluation, and dissemination of information concerning a single incident or multiple incidents in the province of Alberta.
rock groyne	A rock groyne (also known as wing or spur dyke or jetty) in this case is a 20 m x 2 m rock (boulder) structure that is constructed nearly perpendicular to the river bank up and downstream of the protected structure (e.g., bridge pier, pipeline, etc). The purpose is to minimize excessive current that would cause scour or lateral erosion under or around the subject structure.
scour	To clear or dig out (a channel, drain, etc.), as by the force of water.
shotcrete	Also referred to by its trade name of "Gunite." Shotcrete is applied to the outside of the pipeline as a weight material to ensure that the line is nonbuoyant at water crossings.
Sundre Petroleum Operators Group (SPOG)	SPOG is a not-for-profit mutual-aid cooperative that responds to oil-and-gas-related emergencies, as well as interests and concerns of the residents, landowners, and industry operators in the Sundre area and surrounding municipalities.
Stopples®	Stopples plugging machines serve as temporary isolation valves installed anywhere in a piping system. They are used to isolate a pipeline section for repair or addition without interrupting service. The Stopple plugging machine consists of three major sections: a hydraulic cylinder or jackscrew, plugging head housing, and a plugging head.
talweg	A line connecting the lowest or deepest points along the length of a stream or river bed or valley.
Western Canadian Spill Services (WCSS)	WCSS is a volunteer-based company with many member companies that provide volunteers at the field level to ensure that the upstream petroleum industry is prepared to respond to oil spills. WCSS provides oil spill contingency plans for each of 18 cooperatives. It also provides access to oil spill initial response equipment, regional and specialized equipment, and assistance with initial spill response.